PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

INVENTOR(S)	:	Anant Achyut Setlur, et al.
TITLE	:	PHOSPHOR AND BLENDS THEREOF FOR USE IN LEDS
APPLICATION NO.	:	10/797,784
FILED	:	March 10, 2004
CONFIRMATION NO.	:	4139
EXAMINER	:	Mondt
ART UNIT	:	2826
ATTORNEY DOCKET NO.	:	GLOZ 2 00169 (RD29342)

DECLARATION UNDER 37 C.F.R. §1.131

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

1. I, Anant Achyut Setlur, do hereby declare and say that I am a co-inventor in the above-identified United States patent application, Serial No. 10/797,784.

2. I have read and am familiar with the Office Action issued June 30, 2005 in connection with the above-identified United States patent application. I have further read and am familiar with U.S. Patent 6,621,211 to Srivastava et al. (hereinafter "Srivastava").

3. This Declaration is to establish reduction to practice of the invention in this application in the United States at a date prior to September 16, 2003, which is the issuance date and effective §102(a) date of Srivastava. This

Declaration is being submitted prior to a final rejection issuing in the above-identified patent application.

4. To establish conception and reduction to practice of the invention at least prior to September 16, 2003, attached is a redacted copy of an invention record (4 pages) submitted to the General Electric Coporate Research Department (Exhibit A). I hereby declare and say that the relevant portions of Exhibit A predate September 16, 2003, the issuance date of Srivastava.

5. In particular, Exhibit A describes the present invention which comprises the use of the $(Sr,Ba,Ca)_2SiO_4$:Eu phosphor in conjunction with a UV light to produce a lighting apparatus.

6. Each date redacted in Exhibit A is at least prior to September 16, 2003, the §102(a) date of the Srivastava reference.

7. It is submitted that the information attached as Exhibit A clearly demonstrates reduction to practice of the inventive membranes in this country at a date at least prior to September 16, 2003.

8. I hereby declare that all statements made herein are of my own knowledge and are true, and that all statements are made on information and belief and are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Anant Achyut Setlur

Date: 9/29/2005

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Exhibit A

GECRD Patent Disclosure Letter System

DOCKET NUMBER

29342

DOCKET DATE

TITLE OF INVENTION

New phosphor for white LEDs excited by either UV or blue LEDs,(Sr,Ba,Ca)2SiO4:Eu2+, and blends using this phosphor.

INTERESTED GE COMPONENT(S)

- GE Lighting

Keywords:

- Light-Emitting Diodes (LD LD)

CRD PROJECT NAME

LED- NIST Phosphor

CRD PROJECT NUMBER

2079302000

CRD PROJECT LEADER

Becker, Charles A.

BUSINESS OR ORG CONTACT INFORMATION

NAME Bob Karlicek

PHONE NUMBER 8*343-6590

Was this invention first conceived or reduced to practice in the performance of work under a contract between GE and another non-government third party? NO

Date Invention Conceived :

Circumstances Invention Conceived i.e., described in patent notebook (include page #), technical report, letter, discussed in meeting minutes, etc.
This disclosure letter is the first documentation of this invention.

Was this invention first conceived or reduced to practice in the performance of work under a US Government contract, either with CRD or with another component? YES

GOVERNMENT AGENCY NIST

GOVERNMENT CONTRACT NUMBER 70NANB8H4022

Please write a brief explanation of the invention (Limit to 350 words)
We disclose the use of (Sr,Ba,Ca)2SiO4:Eu2+ as a phosphor for LED lighting. This phosphor can be excited by UV or blue LEDs to make white light either alone or when blended with other phosphors.

Please describe the problem or requirement addressed by your invention.
New phosphors need to be developed which can convert UV/blue LED radiation into white light. These phosphors have to have the optimal spectral distribution, quantum efficiency, and absorption for effective use in white LED lamps.

How has this problem or requirement been addressed before?
We have previously disclosed other phosphors which can also be excited by UV or blue LEDs as well as blends of these phosphors.

Is this disclosure letter related to any other CRD or GE disclosure letters, patent applications or issued patents?

NO

Have you completed a prior art search? NO

Please list any relevant literature or patents of which you are aware.

How does your invention work?
(Ba,Sr,Ca)2SiO4:Eu2+ is made via typical solid state methods using oxide and carbonate precursors in a reducing atmosphere. The firing temperatures of these phosphors can be from 900-1500 C. The luminescence of Sr1.90Eu0.05Ba0.05SiO4 is a broad band centered at ~570 nm and is attributed to Eu2+ luminescence in this host lattice. Excitation spectra of this luminescence shows that there is significant absorption of UV and blue light in the relevant ranges for current UV/blue LEDs. Correspondingly, this phosphor can be used either for white LEDs using blue or UV LEDs as the excitation source. For blue LEDs, the phosphor will convert a portion of the incident blue radiation into yellow light. In combination with the blue light bleeding through the phosphor coating, this will give a white light. This phosphor can also be blended with (Y,Gd,La,Lu,Tb,Pr,Sm)3(Al,Ga,In)5O12:Ce garnet phosphors

and Mg fluorogermanate:Mn4+ to reach various color temperatures and CRIs. In UV LEDs, this phosphor can be combined with (Sr,Mg,Ca,Ba,Zn)2P2O7:Eu,Mn (SPP), (Ca,Sr,Ba,Mg)5(PO4)3(Cl,F,OH):Eu, Mn (HALO), (Sr,Ba,Ca)MgAl10O17:Eu,Mn (BAM/BAMn), Sr4Al14O25:Eu (SAE), and/or Mg fluorogermanate:Mn4+ (MFG) to generate white light when excited by a UV LED. The phosphors mentioned above all can be excited by UV LEDs which have a emission peak ranging from 370-405 nm. Initial blending studies show that a Sr1.90Eu0.05Ba0.05SiO4:Eu2+ phosphor blended with SPP and BAM can give a luminosity improvement of ~8% over the current state of the art UV LED blend with a reduction of CRI from 76 to 64. In addition, a biphosphor blend of Sr1.90Eu0.05Ba0.05SiO4 with BAM can also be used for high color temperature blends. Finally,the color of this phosphor could also be tuned with composition by changing the Ba/Sr/Ca ratio. Consequently, we can adjust the phosphor to optimize the blend luminosity and CRI depending on the product application.

Describe the important features of your invention and explain how to use the invention to solve the problems described above.
The use of (Sr,Ba,Ca)2SiO4:Eu2+ in for use in white LEDs with either UV and blue excitation. This phosphor could be used either alone or in blends to generate white light.

What advantages are provided by your invention?
(Sr,Ba,Ca)2SiO4:Eu2+ has high absorption compared to typical UV LED phosphors, which would reduce the UV bleedthrough in white lamps using UV LEDs. It also has significant absorption at 450 nm making it potentially useful for white LEDs with blue excitation.

Has your invention been reduced to practice? YES
Date:

Briefly describe any efforts to make a prototype of your invention or to test your invention. Additionally, summarize the results of any related experiments and testing and highlight any results of particular significance.
Made samples of Sr1.90Eu0.05Ba0.05SiO4. Initial QE was 50% of YAG:Ce, 60% of SPP with an absorption of 60%@450 nm and 76% at 405 nm. Also made spectral blends of this phosphor with other UV LED phosphors.

BRIEF DESCRIPTION OF THE DRAWINGS

Please describe the significance of any pictures, drawings, graphs, diagrams, structures or figures and the type of picture along with the specific view or application to the invention.
Enclosed is an Excel spreadsheet with the excitation and emission spectra of Sr1.90Ba0.05Eu0.05SiO4 as well as spectral blends of this phosphor with SPP and BAM which are optimized for luminosity.

Please identify novel aspects that should be protected within this disclosure letter.
The use of (Sr,Ba,Ca)2SiO4:Eu2+ in for use in white LEDs with either UV and blue excitation. This phosphor could be used either alone or in blends to generate white light.

SrSi2O4.xls

a.	**Have steps been taken to put into use, either outside GE or in our own operations?**	**No**
b.	**Has the invention or a product embodying or using it been sold or offered for sale?**	**No**
c.	**If the invention pertains to a process, have any steps been taken to employ the process commercially (e.g., for product production)?**	**No**
d.	**Has the invention been described in an electronic or printed publication?**	**No**
e.	**Has the invention been described to persons who are not employees of GE?**	**No**
f.	**Are there results available of a prior art search pertaining to this invention?**	**No**
g.	**Has anyone else associated with the project within GE (marketing, sales, sourcing, etc.) disclosed the invention or offered the invention for sale?**	**No**
h.	**If you answered Questions a-g as "NO", is any use, sale, publication, or disclosure of the invention now contemplated?**	**No**

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